ALBERTA ENVIRONMENT GUIDELINES FOR GROUNDWATER DIVERSION

For Coalbed Methane/Natural Gas in Coal Development

April 2004

Alberta Environment

INTRODUCTION

The Government of Alberta is reviewing the regulations that govern coalbed methane/natural gas in coal (CBM/NGC) development to examine the balance between protecting the environment and responsible development.

A Multi-stakeholder Advisory Committee (MAC), chaired by Alberta Energy, is guiding the review process. The MAC has struck a Water Working Group to examine the issues, implications and existing rules and regulations around water, as they relate to CBM/NGC development. These issues include, but are not limited to:

- The anticipated need, in some cases, for dewatering coal zones for CBM/NGC development, versus protection (sustainability) of the aquifers.
- Current regulations prohibiting the co-mingling of groundwater may conflict with CBM/NGC development objectives.
- The need to protect current water users who obtain the water from coal zones that may be targeted for CBM/NGC development.
- The need to protect soils, watercourses, and aquifers from produced water that may be discharged onto lands, into water, or re-injected into non-saline aquifers.

More information on the review process and the issues being examined can be found at www.energy.gov.ab.ca, by following the link for "Natural Gas in Coal/Coalbed Methane."

These guidelines summarize the rules and processes that are currently in place to guide CBM/NGC development where non-saline water is involved. Alberta Environment will consider any adjustments or enhancements to these guidelines or any regulations relevant to CBM/NGC development as recommendations come forward from the review.

LEGISLATIVE AND REGULATORY CONTEXT

Alberta Environment administers the *Water Act* and the *Water (Ministerial) Regulation*, and the *Environmental Protection and Enhancement Act* (EPEA) and *Regulations*.

Alberta Environment's mandate is to ensure the water resources of the province and the environment are sustained for current and future generations.

CURRENT CBM/NGC DEVELOPMENT

All CBM/NGC developers **must** ensure that their operations comply with current requirements. If a CBM/NGC developer is found to be in contravention of the *Water Act*, or the EPEA and the corresponding regulations, the contravention will be investigated and may be subject to enforcement actions.

WATER AND NATURAL GAS IN COAL DEVELOPMENT

Water may be produced in association with CBM/NGC development. The water produced may be saline or non-saline. In Alberta, the *Water Act* and its regulation govern water diversions and activities in water bodies (including aquifers such as coal seams). These guidelines set out Alberta Environment's authorization process applicable to CBM/NGC development and non-saline groundwater diversion. EUB authorization is also required for management of all produced water.

Saline Groundwater

Saline groundwater is water with more than 4,000 milligrams per litre total dissolved solids (mg/L TDS). An Alberta Energy and Utilities Board (EUB) authorization is required for all saline groundwater production and its disposal.

Non-Saline Groundwater

Non-saline groundwater is defined as water with less than or equal to 4,000 mg/L TDS. Alberta Environment must authorize the diversion and use or disposal of non-saline groundwater, including groundwater from a coal zone.

AUTHORIZATION FROM ALBERTA ENVIRONMENT

Before Alberta Environment issues an authorization for water diversion under the *Water Act*, evidence must be provided to Alberta Environment to show that the proposed non-saline groundwater diversion:

- will not cause adverse effects on the water supply of nearby users over the short-term or long-term, and
- will not cause adverse effects (for example, aquifer dewatering) on the source aquifer or other aquifers. (In the *Water Act* "aquifer" means an underground water-bearing formation that is capable of yielding water.)

If a coal seam may contain and produce non-saline groundwater

When a target coal zone is anticipated to contain and produce non-saline groundwater, a CBM/NGC developer must conduct a Preliminary Groundwater Assessment (PGA) containing baseline resource inventory data and other required information, and submit the PGA to Alberta Environment **before** starting drilling or well re-completion activity, or groundwater diversion (see Attachment A).

Before non-saline groundwater is produced

Prior to any non-saline groundwater being produced from a target coal zone, a CBM/NGC developer must apply to divert and use or dispose of non-saline groundwater under the *Water Act*. This application must be submitted to Alberta Environment accompanied by a detailed technical report (see Attachment B) as supporting documentation. Alberta Environment's authorization must be obtained before non-saline groundwater production can start.

Testing for more detailed information for the technical report can only take place **after** a PGA (Attachment A) is properly conducted and submitted to Alberta Environment. CBM/NGC developers are responsible for resolving all allegations of impact on water resources during this testing period.

***Note**: These guidelines supercede Alberta Environment's Groundwater Evaluation Guideline should there be any conflict. The Groundwater Evaluation Guidelines are available at: www.gov.ab.ca/env/water/legislation/guidelines/index.cfm*

PUBLIC NOTIFICATION

After an application is complete public notification is required, often in the form of advertisements in local newspapers. This provides an opportunity for interested parties to submit Statements of Concern within a period specified by the public notice.

The CBM/NGC developer must respond, in writing, to statements of concern from **directly affected** parties and a copy of all correspondence must be filed with Alberta Environment. All parties that submit a Statement of Concern that are considered to be directly affected will have their statements considered prior to an authorization being issued.

CONDITIONS OF AUTHORIZATION

Authorizations will contain conditions under which the project may proceed. Authorization conditions will vary depending on the nature of each project.

Conditions attached to an authorization issued under the *Water Act* typically require production volumes to be metered, on-going water quality analyses, and water levels to be monitored in the target aquifer and overlying and/or underlying aquifer units. Dedicated observation wells completed in the target coal zone and other specific aquifer intervals may be required. These observation wells will be used to monitor the effects of groundwater production and other issues that may arise, such as changes in water quality, within the main project development area and in the larger surrounding area.

CBM/NGC wells that produce non-saline groundwater must comply with the *Water (Ministerial) Regulation*. This regulation prohibits, among other things, the construction of wells with multiple-aquifer completion, and prevents the co-mingling of groundwater of different quality and salinity.

Mitigation

Conditions also require the authorization holder to investigate and resolve any allegations of impact on any existing water supply. Measures to resolve any impact may include lowering the pump, deepening the impacted water well, providing water supply to the well owner for his current water needs, and drilling a new water well.

USE OR DISCHARGE OF PRODUCED WATER

If the produced water is non-saline, Alberta Environment and the EUB may consider surface water discharge or re-injection into an aquifer of a similar water quality, provided that other environmental impacts are addressed. Approval from the federal Department of Fisheries and Oceans may also be required for surface water body discharge. For additional information, please refer to the Department of Fisheries and Oceans website at: www.pac.dfo-mpo.gc.ca/pages/default_e.htm

ABANDONMENT

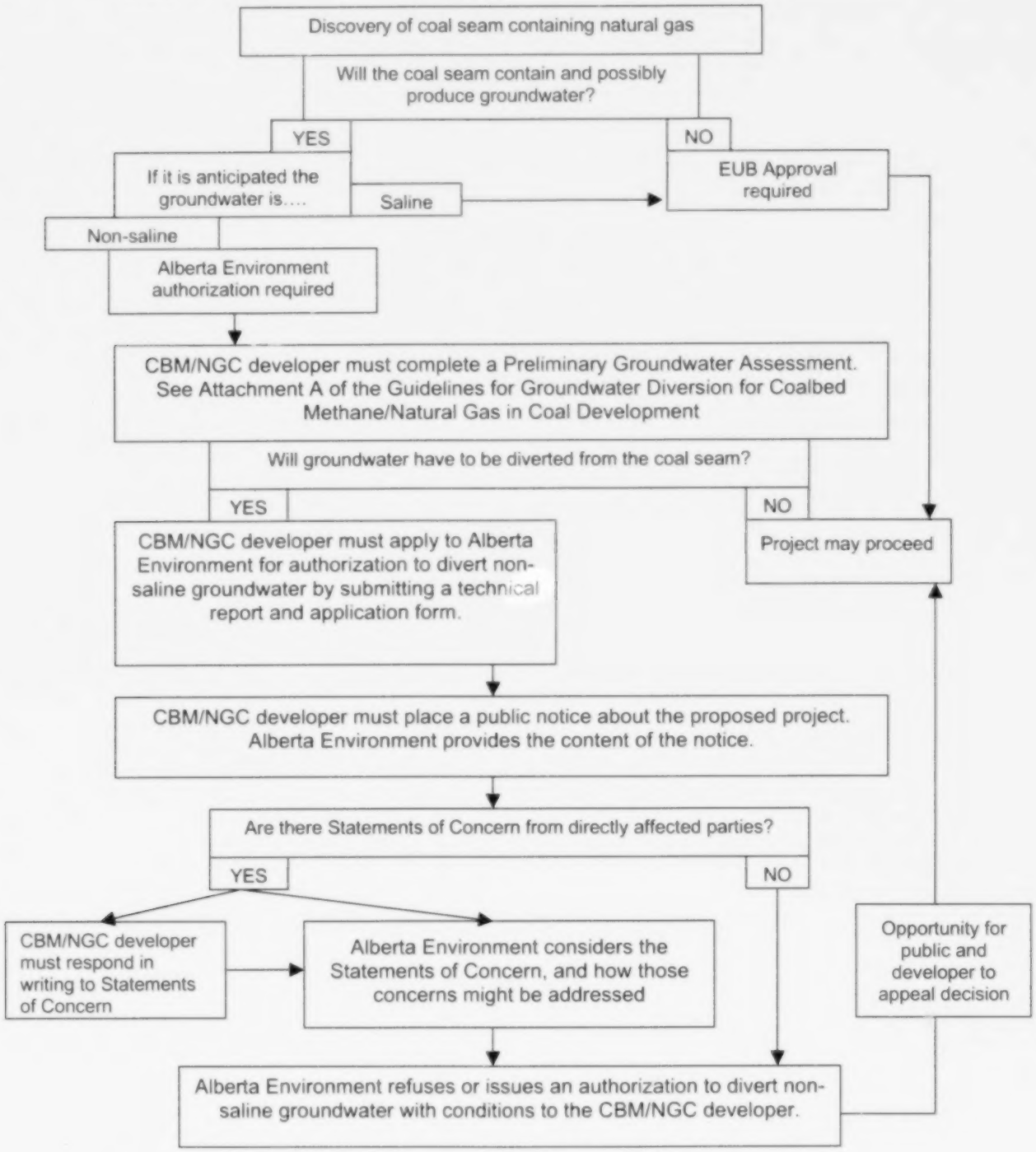
Test holes and all wells drilled for the purpose of investigating, evaluating or producing natural gas reserves, groundwater production, and groundwater monitoring wells must be abandoned in accordance with applicable EUB and Alberta Environment regulations. However, data may still be required to be collected from some monitoring wells to assess the long-term impact after the completion of the CBM/NGC project.

QUESTIONS

Alberta Environment staff can be contacted (see attached map & list) for any questions regarding the application procedure for groundwater diversion under the *Water Act*.

Note: Any expansion to the original work plan would require updated information and a new authorization.

Non–Saline Groundwater Diversion Authorization Process


Discovery of coal seam containing natural gas
Will the coal seam contain and possibly produce groundwater?
YES
NO
If it is anticipated the groundwater is....
Saline
EUB Approval required
Non-saline
Alberta Environment authorization required
CBM/NGC developer must complete a Preliminary Groundwater Assessment. See Attachment A of the Guidelines for Groundwater Diversion for Coalbed Methane/Natural Gas in Coal Development
Will groundwater have to be diverted from the coal seam?
YES
NO
CBM/NGC developer must apply to Alberta Environment for authorization to divert non-saline groundwater by submitting a technical report and application form.
Project may proceed
CBM/NGC developer must place a public notice about the proposed project. Alberta Environment provides the content of the notice.
Are there Statements of Concern from directly affected parties?
YES
NO
CBM/NGC developer must respond in writing to Statements of Concern
Alberta Environment considers the Statements of Concern, and how those concerns might be addressed
Opportunity for public and developer to appeal decision
Alberta Environment refuses or issues an authorization to divert non-saline groundwater with conditions to the CBM/NGC developer.

ATTACHMENT A

PRELIMINARY GROUNDWATER ASSESSMENT

Purpose

The purpose of the Preliminary Groundwater Assessment (PGA) is to collect baseline data and identify issues to regulators and the public.

Background

Alberta Environment is required by legislation to review any situation, with the exception of household use and exempted activities, where non-saline groundwater is diverted. Authorization to divert groundwater under the *Water Act* is required for any operation that produces non-saline groundwater. Non-saline groundwater is defined by a total dissolved solids (TDS) concentration ≤ 4,000 mg/L.

The PGA must be conducted and submitted to Alberta Environment (AENV) prior to any drilling or diversion of groundwater.

Note: Consultation with AENV staff is encouraged. Please refer to the regional office location map and list attached. Consultation should occur before well licence applications are filed with the EUB.

The collection of baseline groundwater resource information, prior to any subsurface investigations for CBM/NGC production, is essential to identify any changes that may be attributed to the pumping of groundwater and the CBM/NGC project activities. Depending on the geological and hydrogeological characteristics of the area, installation of dedicated observation wells may be necessary. These will be used to monitor the effect of groundwater production and other issues that may arise, such as changes in water quality and gas migration.

The Preliminary Groundwater Assessment

The CBM/NGC developer must submit a PGA to Alberta Environment, whenever technical data suggest that the target coal zone may contain and produce non-saline groundwater.

The PGA should be prepared under the guidance of a qualified groundwater practitioner who is a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA).

The PGA must include, but not be limited to the following:

1. A description of the proposed CBM/NGC investigations, including:
   (a) A plan identifying the locations of the proposed test holes, test wells and exploratory wells, any surface water bodies, drainage courses, roads and infrastructure such as village and town locations, etc.
   (b) Tables identifying the legal land location, well depth and completion interval, and surface elevation of all proposed CBM/NGC test holes, exploratory wells, production wells, observation wells and, if known, the locations of possible future CBM/NGC wells.
2. The results of a field-verified survey of water wells, springs and dugouts within at least 1.6 km of each of the proposed test holes and wells described in 1 (b) for the purpose of obtaining baseline conditions in the area. The radius of the field-verified survey must appropriately reflect the scale and the potential impact of the project.
   (a) Descriptive notes outlining the information to be obtained/confirmed during the field-verified survey are provided in Part 2, Section 2.02 (page 10/11) of the "*Groundwater Evaluation Guideline*" available at: www.gov.ab.ca/env/water/legislation/guidelines/index.cfm.
   (b) For CBM/NGC investigations, it is necessary to confirm with the well and/or property owner(s) the existence of gas in any water well(s).

(c) Potential users and receptors of the produced water should be identified and inventoried.

(d) The well/property owners' concerns about the proposed investigations and about the potential project development should be identified and recorded.

3. A detailed description and interpretation of the geology of the area, including plans, cross-sections, and tables identifying, but not limited to:
   (a) The identification of the geologic formation(s) from the ground surface down to, and including the target coal zone.
   (b) The depth, thickness and lithology of each of the main stratigraphic units and of the target coal zones(s) as identified in 3 (a).
   (c) The discussion on the relationship between the target coal zone, the Base of Groundwater Protection, and water wells in the area.
4. A description and discussion of the hydrogeologic conditions in the area, including but not limited to:
   (a) Hydrogeologic cross-sections illustrating the geologic formations and the depth, thickness, elevation, continuity of the target coal zone in relation to the Base of Groundwater Protection and other aquifer units.
   (b) The depths, completion intervals and non-pumping water levels of area water wells relative to the depths of the proposed test holes, to the completion intervals of all exploratory wells, and the depth to the Base of Groundwater Protection.
   (c) The anticipated groundwater withdrawal rates, volumes, and groundwater quality from the coal zone and the potential for cross-flow between the target CBM/NGC zone and adjacent aquifer units.
   (d) The drilling method(s), fracturing method, fracturing fluid, chemicals, etc., that may be used, among other things, during the proposed investigation and well completion program.
5. A conceptual Operational Water Management Plan addressing the handling of produced water during exploration and testing phases. The Plan should describe the proposed method of produced-water disposal. Discussions on the potential effects of the proposed method on the environment such as soil, surface water, groundwater, etc. **Alberta Environment must approve the Plan prior to exploration.**

NOTE: CBM/NGC wells that produce non-saline groundwater and monitoring/testing wells must comply with the *Water (Ministerial) Regulation*. This regulation prohibits, among other things, the construction of wells with multiple-aquifer completion, and prevents the co-mingling of groundwater of different quality within the non-saline zone and the co-mingling of non-saline and saline groundwater. The regulation also prohibits well completion intervals of greater than 7.62 metres (25 feet) unless a distinct aquifer unit of greater thickness is present.

ATTACHMENT B

TECHNICAL REPORT SUPPORTING AN APPLICATION UNDER THE *WATER ACT*

Purpose

The purpose of the "Technical Report Supporting an Application under the *Water Act* " is to present all data collected and interpreted in support of an application for the diversion and use or disposal of non-saline groundwater under the *Water Act*.

Background

Prior to production of non-saline groundwater, an application for groundwater diversion under the *Water Act* must be submitted to the Alberta Environment regional office nearest the CBM/NGC project site (see attached map and list). Supporting data, in form of a detailed technical report, must accompany this application.

CBM/NGC wells that produce non-saline groundwater and monitoring/testing wells must comply with the *Water (Ministerial) Regulation*. This regulation prohibits, among other things, the construction of wells with multiple-aquifer completion, and prevents the co-mingling of groundwater of different quality within the non-saline zone and the co-mingling of non-saline and saline groundwater. The regulation also prohibits well completion intervals of greater than 7.62 metres (25 feet) unless a distinct aquifer unit of greater thickness is present.

CBM/NGC developers are responsible for resolving all allegations of impact to water resources during their preliminary investigations.

The PGA is part of the technical submission in support of an application. Information collected for the PGA must be current when the technical report is submitted.

Supporting report

The detailed supporting technical report must be prepared by a qualified groundwater specialist who is a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta. The report should include, but not be limited to, the following:

1. An overview of existing geologic and hydrogeologic information available for the general area and the results from a field-verified survey of all area water supplies (springs, wells, dugouts).

Information on area water supplies must be interpreted and discussed in the report in support of an application for non-saline groundwater diversion from the coal zone. Specific water well information gathered during the survey must be presented in the report on plans and tables. The plans and tables should contain, among other things, the legal land location; the owner's name; well depth; non-pumping water level (also time and date); completion method and interval; and if gas is present in the wells, the chemical and isotopic composition of gas. A summary of historic chemical analyses should also be included.

Historical water well records are available at www.gov.ab.ca/env/water/groundwater.

2. Discussion of the drilling program by documenting information related to the test hole, test and production well and observation well installations.

The locations of all test holes, test or CBM/NGC production wells and observation wells must be shown on a plan. Table(s) showing the well completion and other data specific to each well should also be included. The number of observation wells installed during the investigation program depends on the site-specific aquifer characteristics and the need to evaluate the ongoing effects of groundwater production on the development area. The hydrogeologist consultant on the project should evaluate the

entire project and determine the number and locations of the observation wells. Lithologs and geophysical logs with interpretation of all holes drilled during the investigations must be provided in the report.

3. Testing and determination of the aquifer parameters.

Pumping tests, also known as well tests or aquifer tests, are commonly conducted to determine the aquifer parameters and assess the sustainable rate at which groundwater can be withdrawn from the producing interval without causing aquifer depletion or impact to other aquifers or users' water supplies in the area. Should the project proceed to the pilot stage, dedicated observation well(s) will be required.

***Note**: The testing period must not exceed 30 days. There must be NO diversion of groundwater from any wells beyond this period unless otherwise authorized by Alberta Environment. The produced water must be disposed of according to the current applicable regulations.*

CBM/NGC developers are responsible for resolving all allegations of impact to water resources during their testing period.

4. Water quality and gas characteristics.

Water quality samples must be collected and analyzed to determine the background water quality of the target coal zone, and other selected aquifer units.

A sample of the gas produced from CBM/NGC wells must be collected and analyzed to establish baseline conditions. The gas should be analyzed for its composition (methane, ethane, propane, CO_2, etc.) and stable carbon isotopes for each of the gases detected.

5. Operational Water Management Plan

A comprehensive Operational Water Management Plan must be prepared for the project. The Plan must address all issues relating to the handling of produced water during all phases of the development. **Alberta Environment and the EUB must approve the Plan prior to the discharge of any water.**

6. Cumulative Impact

Cumulative impact caused by the non-saline groundwater diversion must be assessed for the entire project, including all CBM/NGC production wells.

7. Monitoring

Groundwater availability and the rate of water level decline or recovery within the cone of depression depend on the aquifer parameters, the rate of withdrawal and the pumping period. The heterogeneous nature of the target coal zone and possible hydraulic connectivity with overlying units may cause irregular patterns of drawdown.

Long-term monitoring of water level fluctuations from the target coal zone, and other aquifers, will be required in order to verify the previously predicted well and aquifer response and provide an early warning of any unexpected impacts as a result of pumping.

Monitoring requirements should take into consideration the area residents' concerns about the potential for water level decline and water quality change. Monitoring of water levels in neighbouring wells and dedicated observations wells allows the public and Alberta Environment to ensure that groundwater withdrawal occurs in an acceptable manner and that existing groundwater users are able to maintain their water supplies. Background water quality of the target coal zone, of other aquifer units, the presence or absence of gas, and possibly its composition should be established during the initial investigation program. On-going monitoring of water quality will help identify any changes in its conditions during the CBM/NGC operation.

8. Mitigation of undesirable impacts.

The identification of water wells, their completion interval, water level and water quality within the expected cone of influence will help determine if the proposed groundwater withdrawal potentially affects area water supplies. Methods of mitigating the potential interference concerning water quality, quantity and gas migration with the existing wells and other aquifers must be identified.

LEGISLATION AND REGULATORY TOOLS

Legislation, regulations, codes of practice, policies and guidelines governing energy development in Alberta. Copies are available from the Queen's Printer at: www.qp.gov.ab.ca

Some of the legislation includes:

- *Energy Resources Conservation Act*
- *Environmental Protection and Enhancement Act (and Regulations)*
- *Forests Act*
- *Forest and Prairie Protection Act*
- *Mines and Minerals Act*
- *Oil and Gas Conservation Act (and Regulations)*
- *Pipeline Act*
- *Public Lands Act*
- *Soil Conservation Act*
- *Surface Rights Act*
- *Water Act (and Regulation)*
- *Wildlife Act*

Integrated Resource Plans and other regional policies and strategies also guide development of energy resources such as CBM/NGC.

GUIDELINES/DIRECTIVES/INFORMATION LETTERS

The Alberta government also produces guidelines, directives and informational letters that pertain to the development of energy resources, including CBM/NGC. For further information, visit these links:

Alberta Agriculture, Food and Rural Development

- Farmers' Advocate www.agric.gov.ab.ca/Sdepartment/deptdocs.nsf/all/ofa2621
- ***Alberta Energy***
- Natural Gas (includes NGC) www.energy.gov.ab.ca/com/Gas/CBM/NGC/

Alberta Energy and Utilities Board

- Guides, directives, informational letters www.eub.gov.ab.ca/BBS/requirements/
- Statistical report series www.eub.gov.ab.ca/BBS/products/catalog/statseries
- EnerFAQs www.eub.gov.ab.ca/BBS/public/EnerFAQs/default.htm
- Alberta Geological Survey www.ags.gov.ab.ca

Alberta Environment

- Integrated Resource Management www.gov.ab.ca/env/irm
- Water Management www.gov.ab.ca/env/water/Legislation/index.cfm

Alberta Sustainable Resource Development

- Fish and Wildlife www.gov.ab.ca/srd/fw/index.html
- Public Land Management www.gov.ab.ca/srd/land/
- *Public Lands Operational Handbook* www.gov.ab.ca/srd/land/lad/dl_li.html
- Species at Risk www.gov.ab.ca/srd/fw/escc/aeslist.html
- Surface Rights Board www.srd.gov.ab.ca

Alberta Sustainable Resource Development

- Fish and Wildlife www.gov.ab.ca/srd/fw/index.html
- Public Land Management www.gov.ab.ca/srd/land/
- *Public Lands Operational Handbook* www.gov.ab.ca/srd/land/lad/dl_li.html
- Species at Risk www.gov.ab.ca/srd/fw/escc/aeslist.html
- Surface Rights Board www.srd.gov.ab.ca

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